SAPC 16264
COPY 1 OF 2

"C"

May 28, 1957

GK:

In mulling over the problems of testing the "C" Configuration for the proper focal length Phil and Rod came up with a suggestion which has considerable merit. Any method that would minimize the number of flights required to establish focus would represent a considerable saving in effort. The test device suggested to accomplish this is a simple step wedge utilizing the principle that the path length of an optical ray in glass is longer than in air. Thus, by making a suitable step wedge and placing it near the platen one can have a series of focal plane settings in the area covered by the wedge for any single exposure. This further eliminates the need for the tilted platen and the difficulty of having to square it on again. We are starting to manufacture two such wedges for this purpose in coordination with WAS. The purpose of this letter is to inform you of this fact and that we will prepare in the very near future a quotation for these two items which should run in the neighborhood of $1500.

[redacted] ILLEGIB

TWM:hmm

25X1

 25X1

AERIAL SURVEYING EQUIPM[illegible]NT
PROJECT PLAN

27 May 1957

Brought in by [redacted]

Section 3: Configuration C

3.1 Description

3.2 Specifications

3.3 Design Approach

3.4 Technical Data

3.4.1 Weight Estimate

3.4.2 Power Requirement

3.4.3 Vacuum Requirement

3.4.4 Film Load

3.4.5 Optical Data

3.4.6 Life Cycle and Spares

3.4.7 Programming and Ground Coverage

 25X1

RIAL SURVEYING EQUIPME.
PROJECT PLAN

27 May 1957

Configuration C

3.1 Description

The C Configuration is a 180-inch focal length f/13.8 13-inch by 13-inch format camera. It carries two rolls of film, each 6-3/4 inches wide by 4,000 feet long, which run side by side in opposite directions across the format. The angle of view for a single exposure is 4-1/2 degrees and the camera can scan out to a 60 degree oblique angle to each side of vertical. The camera consists of three basic structures assembled as one unit 48 inches long, 34 inches wide and 54 inches high.

The three basic structures are:

a) The Superstructure which contains film transport system and camera support structure.

b) The Optical Structure which contains optics, platen, and shutter.

c) The Electrical Rack which contains the programmer power supply, amplifiers, junction boxes and cabling.

The camera provides:

a) Automatic stabilizing and Image Motion Compensation.

b) Automatic programming of film transport, vacuum, IMC and shutter operation.

c) Automatic viewing angle variations for stereo overlap and side by side double strip operation.

The controls the operator requires to operate the camera are:

a) Mode Switch: Selects Off, Standby, and Mode 1, 2, 3.

b) Track: Establishes IMC rate and exposure interval.

c) Viewfinder Control Stick: Establishes oblique viewing angle of camera.

d) Burst Switch: Initiates a burst of exposures in Mode 1 operation.

The camera has three modes of operation:

Mode 1: Burst of eight exposures to cover a specific target.

Mode 2: Continuous single line of exposures.

Mode 3: Continuous double line of exposures.

Configuration C

3.1 (cont'd)

Image Motion due to the aircraft forward velocity is compensated by rotating the complete camera about the pitch axis. The drive automatically compensates for varying IMC rates due to oblique position.

The camera is capable of photographing designated target areas that have been selected by observation through a viewfinder which can be directed toward areas considerable in advance of the plane's position and over wide ranges of lateral obliquity. Thus, the operator can locate a target in the finder and give a signal to an automatic computer which will store the angle of obliquity and compute the time at which the target will lie in the range of the camera angle, i.e., in a plane perpendicular to the airplane's axis. As this time is approached, the computer sends a position signal to the camera causing the oblique viewing mirror to assume the proper angle of obliquity, and then photographs the area in a series of frames which completely bracket the designated spot steroscopically. This is Mode I operation.

Minimum sidelap is 10% for all modes.

The weight of the complete camera with film is 550 lbs. (Ref. 3.4.1 weight estimates) This does not include viewfinder, hand control or windows.

3.2 Specifications

3.2.1 Six cameras required. Package four cameras for shipment. Retain one assembled and one unassembled camera in factory storage.

3.2.2 Film load: 4,000 feet. Format 13" x 13". Two rolls of 6-3/4" wide, thin base film traveling in opposite directions. 1/4" nominal space between strips. High resolution emulsion.

3.2.3 Daylight Load Capability

3.2.4 Vertical and oblique angle photography. Any oblique position for $\pm 61.5^{\circ}$. Remote control of oblique angle in flight.

3.2.5 Three modes of operation. Modes may be selected in flight.

Configuration C

3.2.5 (cont'd)

Mode 1: Burst Operation

Eight exposure burst. Four stereo pairs programmed to give side by side photos with 2 sets in line of flight. 2.5 second nominal time between exposures. Two stereo pairs side by side with 10% minimum sidelap, and two stereo pairs along a flight line. Accentuated stereo base obtained by tilting the viewing mirror to view vertically and forward.

Mode 2: Continuous Single Line Operation

Fixed angle position continuous operation. Oblique angle selected in flight. Nominal 2.5 seconds between exposures. 55% minimum overlap.

Mode 3: Continuous Double Line Operation

Two adjacent positions, programmed continuous operation. Oblique angle selected in flight. The two oblique positions straddle the selected sight path. Nominal 2.5 seconds between exposures. 10% minimum overlap and sidelap. Exposure interval adjustment is 9 to 15 milrad/sec. for variation of true v/h for all modes of operation.

3.2.6 Optics

Focal length 180". Aperture f/13.8, non-adjustable.

Combination reflecting and refracting optics using optical reimaging. Oblique photographs obtained by rotating a plane mirror about the roll axis. Accentuated stereo obtained in Mode 1 by indexing the oblique viewing mirror. Angle of view: 4.13°. Diagonal angle of view: 5.67°. Optical elements will be supplied by optical manufacturer.

3.2.7 Aircraft

See Section 9.4.1 for Aircraft Data. Bottom hatch to include a horizontal and two oblique windows. Camera must clear aircraft structure by nominal 1".

3.2.8 Shutter

Focal plane shutter at primary image. Speeds variable from 1/100 to 1/1000 sec. Shutter speed accurate to ±15%. Automatic exposure control with photoelectric control of shutter speed. Shutter mechanism removable for repair or replacement without disturbing lens elements.

27 May 1957

Configuration C

3.2.9 Remote Controls

1. Off - Standby - Run Mode 1, Run Mode 2, Run Mode 3
2. Operation Failure Indicator & Film run-out
3. Configuration Type Indicator
4. Viewfinder - Including:
   a. IMC adjustment (Drift and Track)
   b. Burst operate switch

The Hand Control is remote from the camera and is customer furnished equipment.

3.2.10 Image Motion Compensation

See Section 9.4.1 - Aircraft Data for required values of IMC. Compensation for Image Motion must be accurate to:

365 microrad/sec. = 58 sec. arc/sec. for 1/100 sec. exposure time.

1800 microrad/sec. = 290 sec. arc/sec. for 1/500 sec. exposure time.

3.2.11 Stabilization

Center of gravity mounted. Stabilized about three mutually perpendicular axes; roll, pitch and yaw utilizing solenoid actuators and rate gyros. Expected working excursion $\pm 1/4^{\circ}$. Maximum excursion to snubbers $\pm 3^{\circ}$. See Section 9.4.1 - Aircraft Data for loads, vibration and aerodynamic oscillations.

Stabilization accuracy will be the same as indicated in Section 3.2.10, Image Motion Compensation. The camera will be stabilized prior to each exposure and clamped to the aircraft afterwards in order to obtain a position reference. An automatic weight shifter is used to statically balance the camera about the pitch axis during operation. The stabilizer also provides IMC. This is accomplished by driving the pitch stabilizer at the IMC rate instead of a zero rate.

Configuration C

3.2.12 Automatic Exposure Control

A photoelectric sensing unit automatically controls shutter speed to correct for average light conditions.

3.2.13 Accentuated Stereo Programming

A large stereo baseline of 6.7° is provided by indexing the oblique mirror to view 6.7° forward and then vertically.

3.2.14 Data Recording

The following data is recorded on each exposure of each film strip:

1. Time
2. Frame Number
3. Oblique Angle & Flight Direction
4. Handwritten data

3.2.15 Viewfinder

The viewfinder has a magnification of 1X and 0.4X. The maximum oblique angle is ± 60°. The maximum lead angle is 60°. A self-contained rotatable prism, controlled by the operator is used to adjust camera IMC, the rate being correct when the image of the ground is stationary on the viewfinder. The viewfinder is remote from the camera and is customer furnished equipment.

3.2.16 Computer

A computer is used for Mode 1 operation, which takes oblique angle, lead angle, and IMC information from the viewfinder upon burst operation and stores and converts the data to an oblique angle potentiometer position and a starting pulse to correctly operate the camera when the aircraft reaches the position suitable for photographing the target. Multiple sets of data can be stored to permit the operator maximum freedom in choosing random targets. No provision is made to use overlapping information. Therefore, when targets fall within a certain dead zone, (See 3.4.7 - Ground Coverage), the operator will unknowingly fail to photograph certain targets. The overlapping targets which are lost are those which occur further along the flight line.

The computer is attached to the hand control and is remote from the camera. It is customer furnished equipment.

Configuration C

3.2.17 Dust covers are provided for shipping, storage and installation.

3.2.18 A five-digit non-resetable life counter is included in the camera body.

3.2.19 An oblique indicator shows angle of obliquity and flight direction.

Configuration C

3.3 Design Approach

3.3.1 Studies and Coordination (Reference: Section 3.4.7)

3.3.1.1 Ground Coverage

The basic study includes an analysis of ground coverage for each of three modes of operation showing coverage for verticals 15°, 30°, 45°, and 60° oblique angles. Minimum sidelap and overlap is 10%. In Mode 1 operation each photo is covered twice using stereo. This study determines the exposure interval, the exact stereo angle, the oblique angle, the oblique offset for Modes 1 and 3 and the programming cycle for all Modes. In addition, the dead zone between bursts in Mode 1 is also determined and methods of eliminating or minimizing it are evaluated.

3.3.1.2 Windows

Optical clearance is provided for any oblique position up to ± 61.5° and for IMC and stereo.

Configuration C

3.3.2 Film Drive (Reference: Section 3.4.1, 3.4.4 and 3.4.7)

3.3.2.1 Rollers and Shuffle Assembly

The basic principle of the film drive is that of a continuously moving supply and take-up spool with film shuffles on the supply and take-up side of the platen to keep the film stationary during the exposure period. Identical systems are used for each film strip. In addition, a common metering roller for both film strips assures metering the same amount of film. Therefore, the same footage of film is metered in both directions, providing an approximate center of gravity balance. A single motor-tach operates the metering roller. This is servo controlled at a rate proportional to v/h. Therefore, a constant overlap is maintained.

The film shuffle and metering drive assemblies are packaged as an inegral unit to be removable from the camera for repair or replacement.

A switch is actuated when the film supply is exhausted which de-engergizes the "configuration type indicator light" on the control panel.

Configuration C

3.3.2.2 Take-up Drive

Due to the large change in spool diameter and variation in IMC, the film tension would normally vary over a wide range if a constant torque were used. Therefore, the take-up spools are driven by separate electric motors which are controlled by a film tension sensing device. This mechanism automatically varies motor torque to maintain it within safe limits.

Configuration C

3.3.3 Structure and Optical Support (Reference: Section 3.4.1, 3.4.3)

3.3.3.1 Structure

A light-weight structure holds the optical components, the oblique mirror and the platen in optical alignment. This structure is mounted to a frame containing the cassettes and film drive. The structural system is kinematically designed to prevent cassette and film loads from causing deflection of the optical frame.

A complete stress analysis is used to evaluate the structural design with the purpose of reducing weight consistent with the required loads.

3.3.3.2 Timer

A spring-wound stop watch and magnetic counter with built-in light source and a double optical system records time and exposure number on the margin of each film strip upon each exposure. Space is available for writing the flight number and other data. The data chamber is easily removable from the camera for winding and adjustment on the preflight check.

3.3.3.3 Oblique Angle and Flight Direction Recorder

The oblique viewing position and the flight direction at the time of each exposure is recorded on each film strip. The mechanism is operated by the oblique drive.

3.3.3.4 Platen and Vacuum System

The platen is constructed of an aluminum honeycomb core with a thin surface plate which is machined to the required contour. It includes slots for applying vacuum during the exposure period.

A solenoid vacuum valve flattens the film. The vacuum line is flexible and runs near the camera C.G. to minimize any restraining torque.

27 May 1957

Configuration C

3.3.3.5 Shutter Support

An intra-lens focal plane shutter which is easily removable for maintenance is mounted at the primary image plane. The shutter mounting is attached to the optical structure to prevent vibration being transmitted to the lens barrel. Clearance with the oblique mirror and shutter is coordinated.

3.3.3.6 Heater

The projection lens system is electrically heated and thermostatically controlled within $\pm 1/2^\circ F$. Auxilary electrical heaters are also used on the optical structure to obtain accurate temperature control.

3.3.3.7 Focusing

One reflecting mirror incorporates a linear screw adjustment and lock in the mount to provide manual focusing adjustment.

3.3.3.8 Tilted Platen

One reflecting mirror incorporates means whereby it can be tilted a fixed amount to simulate a tilted platen for focusing checks.

3.3.4 Rocking Mirror Mount and Drives (Reference: Section 3.2.15, 3.4.7)

3.3.4.1 Mirror Mount

The aluminized front surface mirror is constructed to quartz which is hollowed out to reduce weight and stresses. It is supported on the rear surface by means of flexures and a mounting plate. The mirror is mounted to provide freedom of rotation about the roll axis for oblique viewing. Freedom of rotation about an axis perpendicular to the viewing axis is also provided for stereo viewing in Mode 1.

Configuration C

3.3.4.2 Oblique and Oscillating Drive

The oblique mirror is driven to a viewing angle corresponding to a pilot-controlled potentiometer. This potentiometer is directly driven by the viewfinder in Modes 2 and 3 operation and indirectly controlled through a computer in Mode 1 operation. A null circuit is used to obtain accurate positioning. In Mode 2 operation, the mirror position corresponds with the aim point. However, in Modes 1 and 3, an oscillating drive indexes the mirror on both sides of the target in accordance with the program of Section 3.4.7.

A brake is incorporated to prevent mirror motion during exposure. The oblique positioning servo is designed to permit extreme mirror positioning $\pm 60^{\circ}$ in one cycle of operation.

3.3.4.3 Stereo Drive

In Mode 1 operation a stereo drive indexes the oblique mirror to view vertically and forward to obtain an accentuated stereo effect. The position is programmed in accordance with Section 3.4.7. The stereo frames are superimposed, thus facilitating interpretation of single frames. A cosine computer compensates for reduced stereo with increasing obliquity.

3.3.5 Shutter

A focal plane shutter is used at the primary image plane providing continuously variable speeds of 1/100 to 1/1000 seconds. The type of shutter used incorporates a slotted rotating disc and a rotating vane which normally covers the slot. The disc and vane rotate continuously at high speed and have an adjustable angular separation to set the effective shutter speed. The disc and vane are separated during a partial revolution prior to exposure. They automatically return to a capped position immediately after exposure. The shutter efficiency is very high since the rotating discs can be located near the plane of the primary image. The shutter is easily removable for servicing and test.

An automatic shutter control based on average light conditions controls the slit size of the shutter automatically.

Configuration C

3.3.6 Programming (Reference 3.4.7)

In Mode 1 operation eight cycles are automatically programmed. The starting pulse and angle representation are supplied by the computer. After the program starts the computer information is disconnected from the camera.

In Modes 2 and 3 operations, the camera operator directly controls the oblique angle and the starting time. The programmer operates continuously until the mode switch is changed.

The speed of the programmer drive is adjustable through the hand control to compensate for variation in IMC.

3.3.7 Electrical System

Radio noise is minimized by means of filters and shielding which to the degree found necessary meets MIL-I-6181-B except frequency range to be 150 K.C. to 150 M.C. Connectors to the airframe are provided which are compatible with other camera systems.

3.3.8 Shutter Control

A light-sensitive cell averages the light condition near the format area and provides this information to a servo loop. A servo motor actuates the slit control mechanism of the shutter to provide continuously adjustable speeds. No diaphragm control is used.

27 May 1957

Configuration C

3.3.9 Gimbal

The camera is supported on a three, mutually perpendicular, axis, flexure mount at the camera's center of gravity. Forces causing camera rotation due to translation of the support point are minimized by the C. G. mounting. The flexures are de-stabilized about the roll and pitch axis. However, since it is difficult to destablize the yaw flexures, the spring restraint is reduced to the minimum compatible with the strength requirements. The flexures are designed to be removable and to support the camera under maximum gravitational loading. In the event of failure, the gimbal structure is designed to prevent camera break-away from the camera mount.

3.3.10 Stabilizer (Reference: Section 3.2.10, 3.4.1.1., 9.4)

The stabilizer system functions as a dynamic damping device such that when the rate of angular displacement of the camera (as detected by a rate gyro) exceeds a very low value, an actuator returns the camera to a rate consistent with the requirements of Section 3.2.10. Since this device does not provide a position reference, a recentering device automatically repositions the camera in respect to the airframe periodically. A one-axis breadboard was used to explore the feasibility of the design approach and to investigate design parameters.

3.3.11 Automatic Counterbalance

Static unbalance occurs about the pitch axis due to differential film metering and varying film size and density. Compensation is provided by an automatic weight shifting device. This is a two directional device which is energized by a pulse from the pitch rate gyro. The switching direction and pulse time determines the direction and amount of weight shift. The resultant effect is one of long time integration to compensate for slow static unbalance.

3.3.12 Caging

A caging device automatically recenters and releases the camera periodically to correct for camera drift and IMC. The device releases the camera gently to prevent introducing uncaging torque. The camera is rigidly locked to the airframe when in OFF, STANDBY or during power failure.

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN

27 July 1956

Configuration C

3.4.1.1 Moment of Inertia and Weight of Stabilized Components

	Moment of Inertia Normal (slug ft.^{2})
Yaw	8.9
Roll	11.9
Pitch	19.5

Est. Weight of stabilized components = 368 lbs.

Configuration C

3.4.2 Power Requirements

27.5 ± .7 Volts, D.C.
400 cycle (+ 0-4%)

	A. C.		D. C.	
	Surge	Run	Surge	Run
Film Drive Motor			5A	1.25A
Film Drive Servo	30VA	10VA	1A	1A
Film Take-Up Motor #1			3.	1.5
Film Take-Up Motor #2			3.	1.5
Film Take-Up Regulator			1	
Oblique Drive	30VA	20VA		
Stereo Drive			2.5A	
Shutter Motor	50VA	20VA		
Stabilizer	200VA	75VA	1A	1A
Exposure Controller			1A	0.25A
Programmer				
Relays & Stepping Switches			4A	2A
Vacuum Solenoid			4.5A	
Camera Heater	500VA	500VA		
	810VA	625VA	26A	8.5A

3.4.3 Vacuum Requirement

Pressure Differential 1 1/2 in. Hg.

1-1/2 cu. ft. per minute

AERI AL SURVEYING EQUIPMENT

PROJECT PLAN

27 July 1956

Configuration C

3.4.4 Film Load

The film load will consist of twin 6-3/4" wide rolls of special aero emulsion on a thin strengthened acetate base in quantities as tabulated based on a wrap thickness of .0034" and 13.2 pounds/1000 linear feet.

Outside Diameter Of Roll With 4" Core Diameter In.	Length Per Roll Ft.	Exposures 13.5" ea.	Weight Per Roll Lbs.	Total Weight Per Camera Lbs.
Normal Load 16 3/4 inch	4000	3500	50.	100

Configuration C (Cont'd)

3.3.13 Internal Torque Compensation

In order to prevent the generation of internal torques, the motors and mechanisms have their angular momentums equalized with respect to each other wherever practical. In addition, the drives are also dynamically balanced to prevent the generation of an erraneous signal which may be picked up by the rate gyros. Operating mechanisms are also vibration isolated wherever practical to prevent the optics from vibrating.

3.3.14 Flight Test Analyzer

In order to accurately determine the stabilization requirements a flight test analyzer was designed to obtain a three axis Fourier analysis of the aircraft motion under actual flight conditions.

Configuration C

3.3.15 Cassette and Spools

Identical supply and take-up spools are mounted on common shafts in the film cassettes. In order to run the film through the format with 1/4" between strips, the spools are located on a common shaft with 1/4" spacing between film strips. Skew guiding of the film strips which leads to undue complexity with the possibility of malfunctioning is thus eliminated.

The cassettes and spools are designed to minimize any possibility of C. G. shift in occur in either loading into the camera or in operation.

In loading the cassettes in the camera, the cassette covers are kept closed and the ends of the film are spliced. Pressure sensitive tape is used to splice leader to trailer. The purpose of this splice is merely to carry the leader onto the take-up spool for a few turns, after which time it is no longer in tension.

3.3.16 Film and Cassette Handling

A jig for splicing film is supplied which accurately registers the four strips of film while they are spliced.

The film cassettes are accurately weighed and balanced prior to loading into the camera to balance the camera on a horizontal line. Varying film loads affect the C. G. location. Therefore, an adjustment is provided to compensate for this variable.

Provision is made to assure that film used on the two film strips for any run are obtained from the same batch. This precaution is taken to assure that the same emulsion is being used, that aging is the same and that the thickness of the film base is the same for the two film strips. Matching the film base permits better balancing when the film is run through the camera.

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN

27 May 1957

Configuration C

3.4.1 Weight Estimates

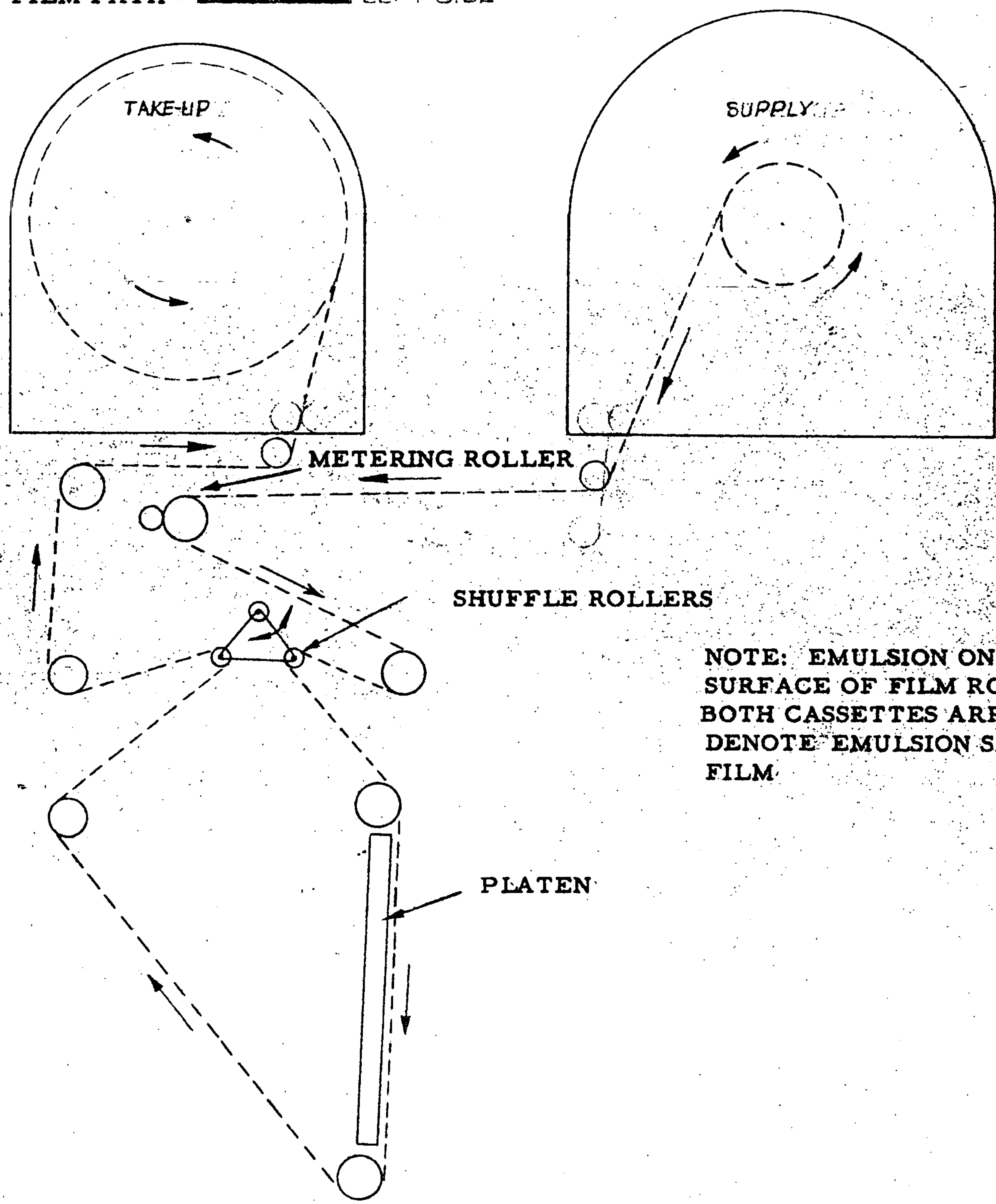
		Target Weight of 3/23		Estimated Weight		Actual Weight	
1.	Viewfinder and Computer	20		25		---	
2.	Recorder	10		10		---	
3.	Charting Camera	40		40		---	
4.	Equipment Sub Total		70		75		---
5.	4 Spools Assys (with shafts)	28		11		25	
6.	2 Cassettes	24		20		17	
7.	Shutter and Control	4		5		10	
8.	Stereo and Oblique Mirror Drive	8		12		35	
9.	Platen	20		6		5	
10.	Structure	40		66		115	
11.	Film Drive Rollers and Gear Train	10		12		17	
12.	Film Drive Motors	4		11		8	
13.	IMC Servo	4		4		---	
14.	Controls (Junct. Box)	10		10		25	
15.	Cabling	6		6		14	
16.	Mass Stabilizer	20		25		80	
17.	Minivib	-		-			
18.	Structure Sub Total		178		188		351
19.	Lens and Barrel	55		65		72	
20.	Mirror, Moving	10		15		17	
21.	Windows	30		72		---	
22.	Optics Sub Total		95		152		---
23.	Film	107		100		110	
24.	Total		450		515		---

Approved For Release 2004/05/13 : CIA-RDP89B00980R000400090010-1

CONFIGURATION C

3.4.4 (Cont'd.)

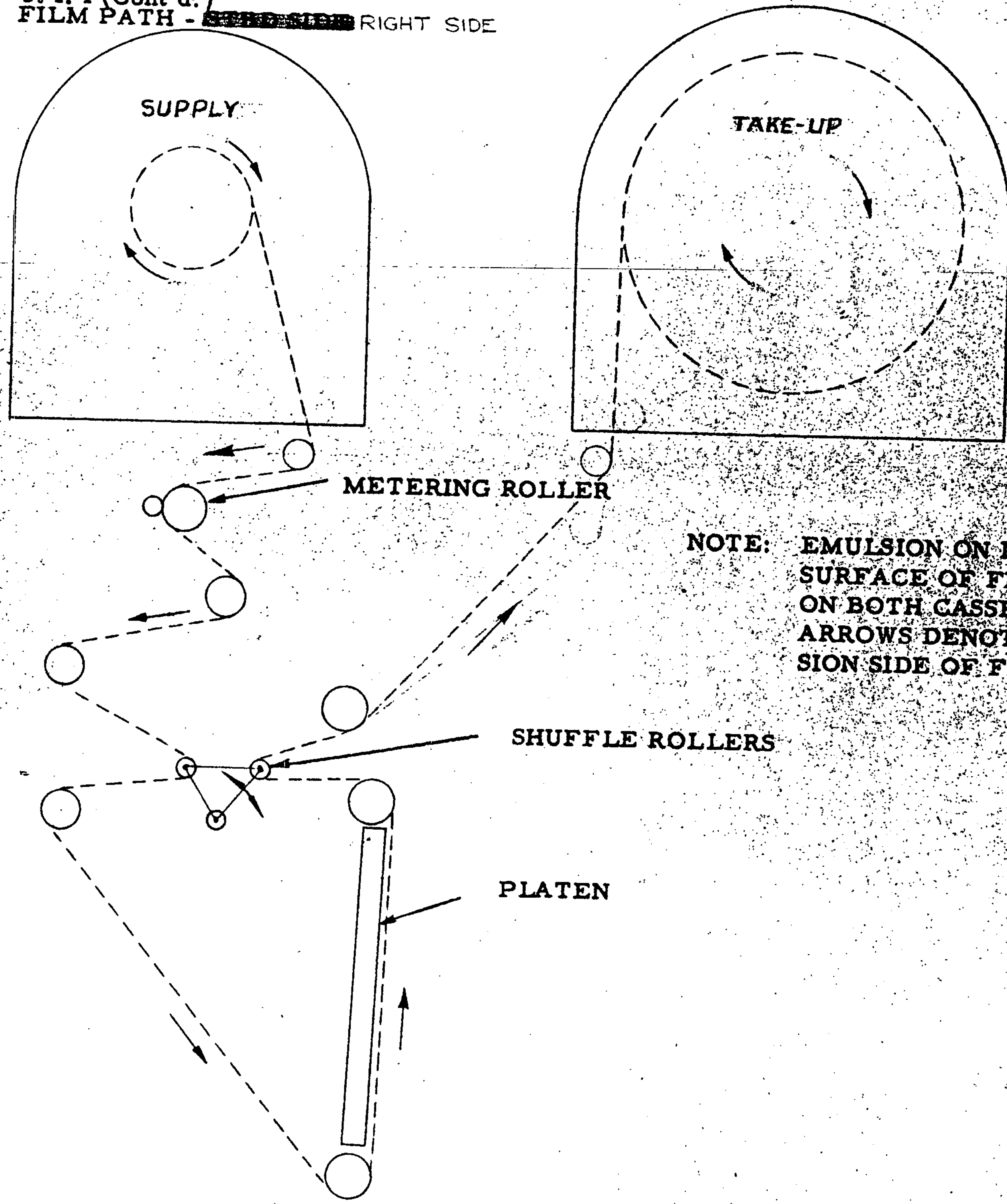
FILM PATH - [redacted] LEFT SIDE



NOTE: EMULSION ON INSIDE SURFACE OF FILM ROLL ON BOTH CASSETTES ARROWS DENOTE EMULSION SIDE OF FILM

A IAL SURVEYING EQUIPMENT
PROJECT PLAN
27 JULY 1956

CONFIGURATION C
3.4.4 (Cont'd.)
FILM PATH - [redacted] RIGHT SIDE



NOTE: EMULSION ON INSIDE SURFACE OF FILM ROLL ON BOTH CASSETTES ARROWS DENOTE EMULSION SIDE OF FILM

Configuration C

3.4.5 Optical Data

180-inch f/13.85 "C" system. December 20, 1955

Not to be constructed but satsifactory for ordering glass.

Surface	Radii (inches)	Separations Glass (inches)	Separations Air (inches)	Glass Type	Clear Apert. (1)	Clear Apert. (2)
1)	plano		35.88	Quartz Flat	13.000 pupil	
2)	78.929		36.625	Quartz Primary	15.760	15.760
3)	5.937	0.540		LaK-9	4.094	3.672
4)	13.827		0.036		3.952	3.506
5)	4.262	0.913		LaK-9	3.764	3.344
6)	9.613	0.360		SF-8	3.310	2.866
7)	2.861		1.620		2.868	2.488
8)	-3.682	0.360		SF-8	2.728	2.376
9)	-4.919	0.908		LaK-9	2.916	2.564
10)	-4.932		0.036		3.312	2.978
11)	27.69	0.540		LaK-9	3.428	3.098
12)	-17.083		5.705		3.480	3.176
13)	27.082	0.954		LaK-9	4.208	4.208
14)	-5.806	0.450		SF-8	4.228	4.228
15)	-10.591		0.043		4.252	4.252
16)	12.782	0.540		FK-6 Sp.	4.158	4.158
17)	3.344	2.160		CaF-2	3.904	3.904
18)	-4.212	0.540		FK-6 Sp.	3.632	3.632
19)	5.928		2.880		3.356	3.356
20)	-3.466	0.540		FK-6 Sp.	3.682	3.682
21)	8.873	2.160		CaF-2	4.692	4.692
22)	-2.820	0.540		FK-6 Sp.	4.964	4.964
23)	-5.253		0.035		5.832	5.832
24)	134.34	0.450		SF-8	6.344	6.344
25)	11.615	1.080**		LaK-9	6.602	6.602
26)	-11.729		74.774*		6.638	6.638

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN

27 July 1956

Configuration C

3.4.5 (Cont'd)

* Back focus in 5876 angstroms.

** This lens thickness is to be increased to 1.220 for the f/13.85 system given here, if adopted. If the pupil is reduced to 12.000 inches, the thickness might be 1.150. If 11.000 inches, it can be left at 1.080.

The left hand clear aperture column refers to maximum values (corner of format). The right hand column refers to extreme rays at f/13.85 to the side of the format. The projection lens is unaffected. (The vignetting at the corner is about 15%).

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN

27 July 1956

Configuration C

3.4.6 Life Cycle and Spare Parts

The four cameras must function throughout 100 flights between major overhauls with certain regular maintenance operation. This is 25 flights each.

OPERATION REQUIREMENT

	Exposures	Mode	IMC rate (rad/sec) Nominal	Time/ Photo (Sec.)	Time per Burst(sec.)	Time per Flight (hours)	Time per 100 Flights (hours)
Normal Load	3500 exp/ flight or 350,000 exp/100 flights 430 bursts/ flight	1	.012	2.55	20.4	2.5	250
		2	.012	2.55		2.5	250
		3	.012	2.55		2.5	250

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN

27 July 1956

Configuration C

3.4.7 Programming and Ground Coverage

Summary of Camera Characteristics

	Mode 1	Mode 2	Mode 3
IMC Rate (mil rad/sec)	12 ± 3	12 ± 3	12 ± 3
Angular Coverage (oblique)	7.3°	4.1°	7.3°
Oscillating Angle (δ)	± 1.5°	0	± 1.5°
Stereo Angle (γ)	6.67°	1.67°	0
Obliquity Range ($\alpha \pm \delta$)	± 61.5°	± 60°	± 61.5°
Cycle Interval	1.75°	1.75°	1.75°
	2.55 sec.	2.55 sec.	2.55 sec.

Following is applicable to Mode 1:

Duration of one burst	13.4° (20.4 sec.)
Angular coverage in direction of flight line	9.4° max.
Minimum interval between targets--nominal	13.4° (20.4 sec.)

Configuration C

3.4.7 (cont'd)

Lead Time for β Command - - Nominal	10.8°
Duration of β command pulse	unavailable
Lead Time for α Representation - - Nominal	10.8°
Duration of α representation	unavailable

Nomenclature

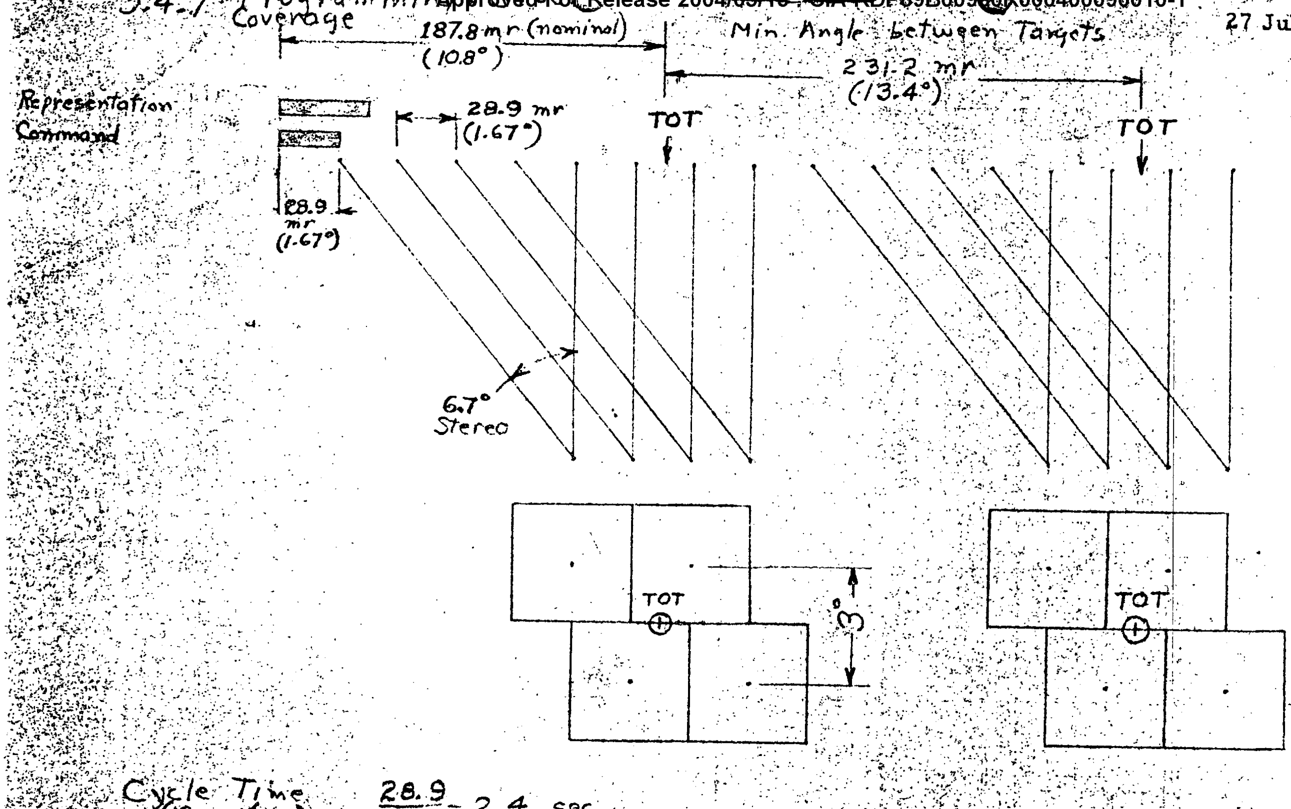
Beta command: Pulse from computer to start camera cycle for burst prior to time on target.

Alpha representation: Angle of obliquity.

CONFIGURATION C   MODE 1

Aerial Surveying Equip
Project Plan
27 July 1956

3.4.7 Programming of Coverage



Cycle Time (12 mr/sec.) $\frac{28.9}{12} = 2.4$ sec.

Camera Angle $\frac{13}{180} \times 57.3 = 4.13°$

Mirror Motion: Forward = 3.35° to vertical
Oscillating = ±1.5°
Rocking = in accordance with position of hand control.

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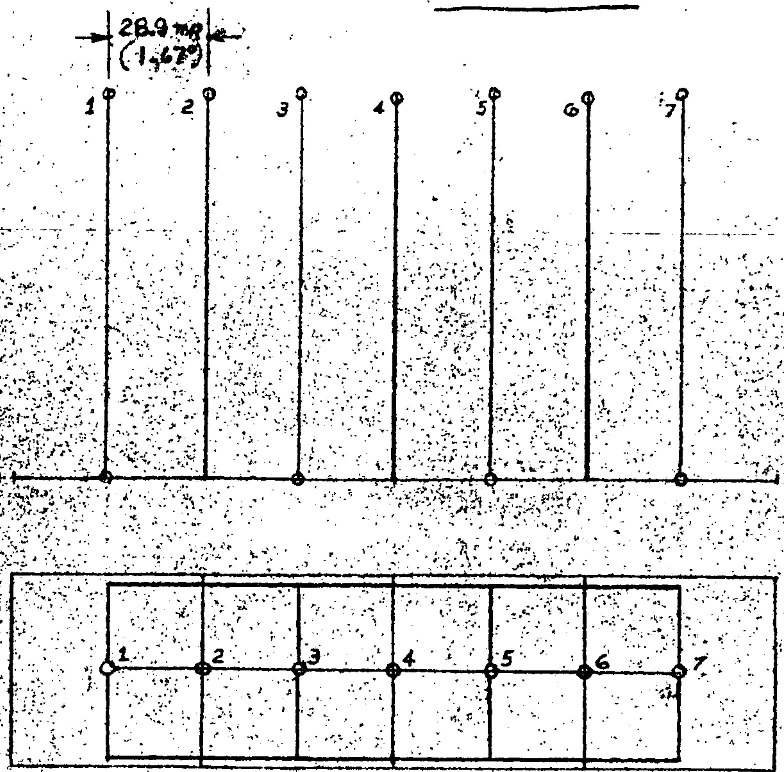
27 July 1956

3.4.7 Programming and Ground Coverage

Mode 2

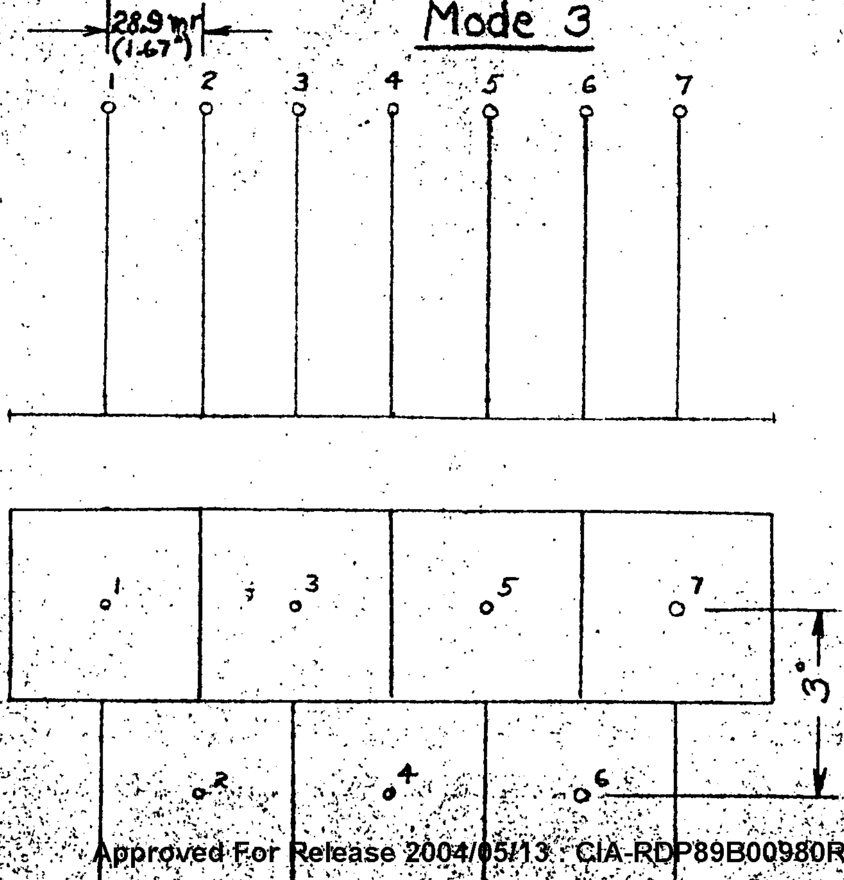


Cycle time = 2.4 sec.
(12 mr/sec.)

Mirror Motion:

Forward = none
Oscillating = none
Rocking = to follow hand control.

Mode 3

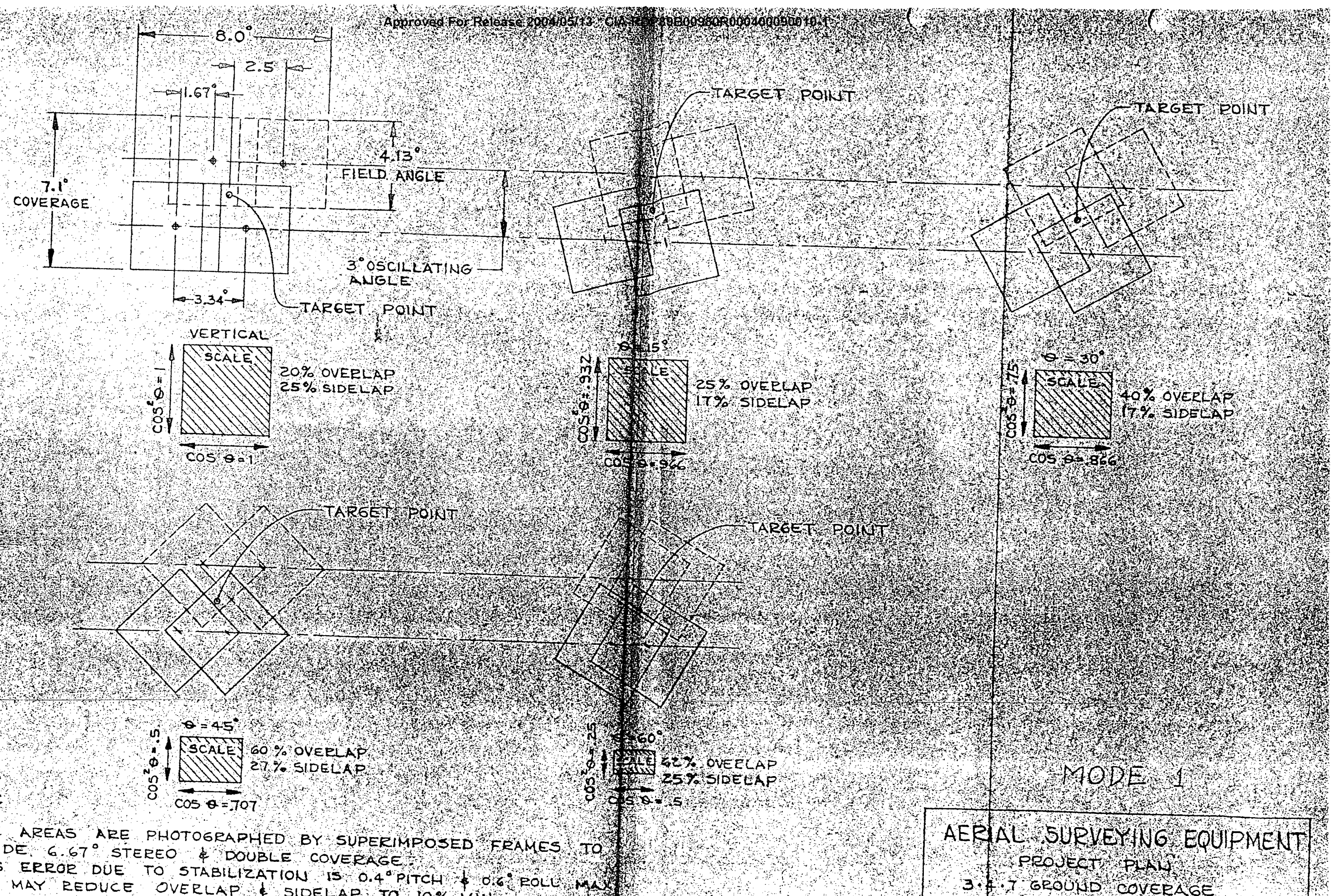


Cycle Time = 2.4 sec.
(12 mr/sec.)

Mirror Motion:

Forward = none
Oscillating = ± 1.5°
Rocking = to follow hand control.

PCR



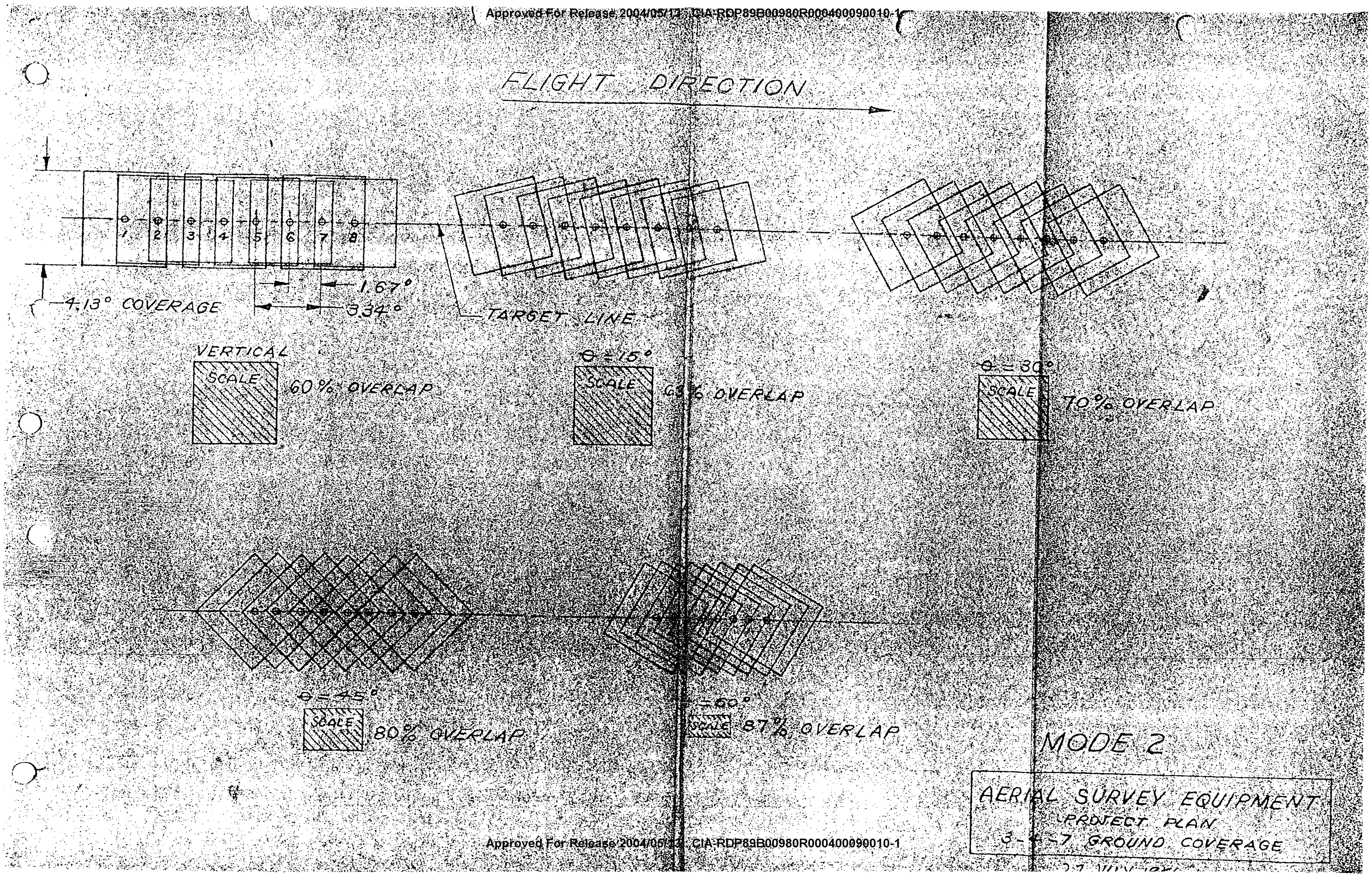
NOTES:

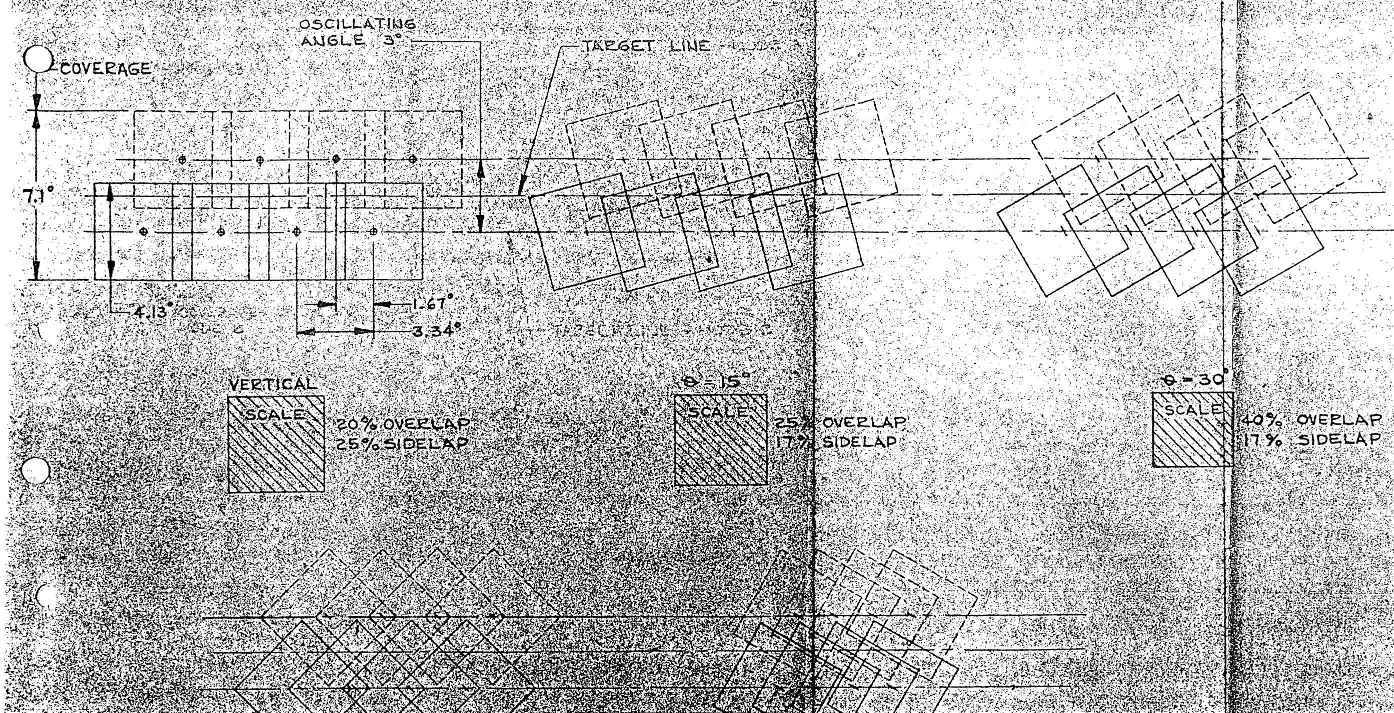
1. ABOVE AREAS ARE PHOTOGRAPHED BY SUPERIMPOSED FRAMES TO PROVIDE 6.67° STEREO & DOUBLE COVERAGE.
2. AIMING ERROR DUE TO STABILIZATION IS 0.4° PITCH & 0.6° ROLL MAX. THIS MAY REDUCE OVERLAP & SIDELAP TO 10% MIN.

MODE 1

AERIAL SURVEYING EQUIPMENT
PROJECT PLAN
3.4.7 GROUND COVERAGE

27 JULY 1956


FLIGHT DIRECTION
1 2 3 4 5 6 7 8
1.67°
4.13° COVERAGE
3.34°
TARGET LINE
VERTICAL
SCALE
60% OVERLAP
θ = 15°
SCALE
63% OVERLAP
θ = 30°
SCALE
70% OVERLAP
θ = 45°
SCALE
80% OVERLAP
θ = 60°
SCALE
87% OVERLAP
MODE 2
AERIAL SURVEY EQUIPMENT
PROJECT PLAN
3-4-7 GROUND COVERAGE



MODE 3

NOTES:

1. NO STEREO IS OBTAINED IN ABOVE COVERAGE EXCEPT FOR THE OVERLAP AREAS.
2. AIMING ERROR DUE TO STABILIZATION IS 0.4° PITCH & 0.6° ROLL MAX. - THIS MAY REDUCE OVERLAP & SIDELAP TO 10%

AERIAL SURVEY EQUIPMENT
PROJECT PLAN
3-4-7 GROUND COVERAGE

27 JULY 1956

SAPC 13349
COPY 2 OF 2

25X1

[redacted]

"C" Camp

February 12, 1957

George:

25X1

Our [redacted] brought back some snips of the "C" negatives which were obtained on the January 31st operation. Considering the size and complexity of the system I was quite pleased as was Rod. The over-all negative shows about six lines per millimeter resolution with no area any better than any other. There is variation of quality from frame to frame, indicating that we still have some work to do on stabilization and IMC. The exposure and contrast is surprisingly good, indicating we have a highly effective system since the shutter speed was approximately 1/150th per second. One roll (half the picture) was processed at [redacted] 25X1 and the other half was sent to [redacted] for processing. There was no 25X1 indication from the few snips I had of any condensation problems. That is about all the technical data I have available at the moment. The weather, of course, has been delaying additional operations.

I discussed the weight problem with Will, and his recollection is that the loaded camera weighs 550 lbs. To this should be added 70 lbs. for the windows, making a total of 620 lbs for the system exclusive of the "bag" hatch and auxiliary gear, such as the nitrogen bottle.

[redacted] 25X1

TWM:hm

DOCUMENT NO.
NO CHANGE IN CLASS. ☐
DECLASSIFIED
CLASS. CHANGED TO: TS S C
2011
NEXT REVIEW DATE:
AUTH: HR 70-2
DATE: 8/5/81 REVIEWER: [redacted] 25X1